Vol. 15 OCTOBER, 1950 No. 10

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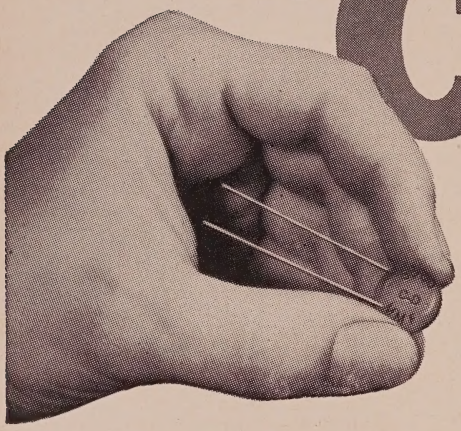

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RADIART SUBSIDIARY

SENSITIVE RELAY CIRCUITS

A wide variety of workaday tasks can be performed by sensitive relay circuits. For example; these circuits, either by themselves or in combination with heavier relays or electromechanical switches, can utilize a. c. or d. c. control signals of low current, voltage, or wattage to control high-power devices. Thus, heavy switches may be operated, motors controlled, remote communication equipment switched on or off, door-opening machinery operated, and electromechanical counters actuated by low currents transmitted by wire or radio or obtained from illuminated photocells or phototubes. Sensitive relay circuits are important also for obtaining positive action from extremely light-duty make-and-break contacts which must be closed at low voltage levels to prevent sparking and sticking.

Any phenomena, such as sound variations, pressure changes, and mechanical movement which can be converted into small electrical impulses can be utilized for the performance of work or for signalling, by means of sensitive relay circuits. The experimenter is conversant with several common relay circuits which employ vacuum tubes to operate relays. Each of these circuits employs the same basic principle. The relay coil is connected in series with the tube plate and the plate-voltage supply, in order that plate current must pass through the coil. The plate current is pre-adjusted to a value somewhat lower than that required to pick up the relay. When a signal voltage then is applied between the control grid and cathode of the tube, the plate current through the relay coil will increase, in accordance to the grid-plate transconductance of the tube, and the relay will close. When the signal voltage subsequently is removed, the relay will drop out. Because the grid input circuit of the tube is high in resistance, the circuit will draw little or no current from the control-signal source. In this way almost no power at all is required from the signal source, although the relay requires a respectable operating current and power.

Not all sensitive relay circuits employ tubes. Copper oxide rectifiers frequently are used to operate low-current d. c. relays from audio-frequency control signals, and crystal diodes are used in the same way with radio-frequency control signals. Whether tubes will be needed, and how many, depends upon the amount of sensitivity required.

The Editors have received periodic requests for relay circuits which can be operated with low-power control signals. Many requests for information deal with specific applications which can be served only by special equipment, but a good many requirements can be handled by standard circuits of proven performance. In response to this interest, we have selected several tested circuits for use with a. c. and d. c. control and present them in this issue of the CAPACITOR. These circuits will be satisfactory for the usual run of applications and may be used, as shown.

D. C. Circuits

Meter-Type Relay. The Weston Model 705 "Sensitrol" relay provides direct operation between 2 and 10 microamperes d. c. This is a small-sized movable-coil unit of the d'Arsonval type, similar in construction and operation to a standard d. c. microammeter. The movable contact is on the end of an arm comparable to the pointer of a meter.

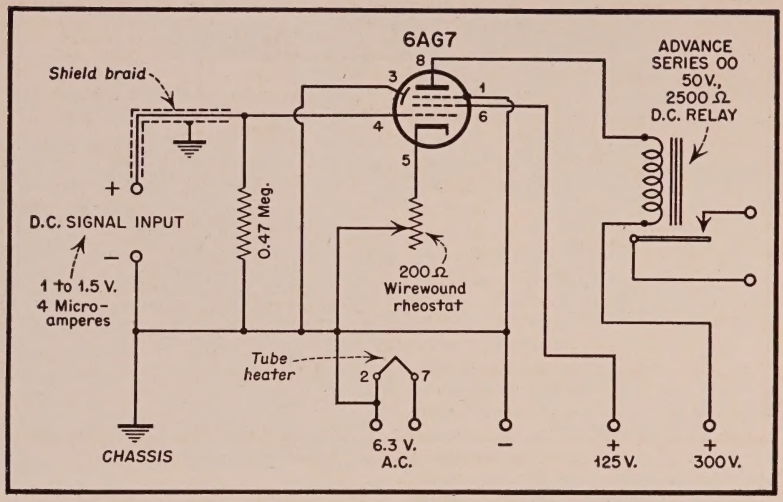

Fig. 1. Circuit of low-signal d. c. relay.

In operation, the small control current flowing through the movable coil of the relay deflects the movable arm away from its position of rest. Along its arc of swing, the arm enters the field of the stationary contact which is permanently magnetic and is mounted at the end of the arc (a position corresponding to full-scale of a meter). The magnetic contact (stationary) pulls the movable contact through the rest of the arc and into positive contact with itself. After closure, the relay must be reset by separating the two contacts. A knurled external knob is provided for this purpose and may be operated by hand or by means of a reset motor or solenoid.

The magnetic contact relay has the slight disadvantage that it must be reset between operations. It is of value, however, in that its contact is positive and free from the chatter due to lightness of contact in non-magnetic microampere-type relays of the meter type.

The contacts of the Model 705 relay will handle 5 watts at 110 volts. Where higher power levels must be switched, the Model 705 may be used to close a second "work" relay having heavier contacts.

Audio-frequency operation of the Model 705 may be obtained by rectifying the control-signal voltage with a small meter-type copper oxide rectifier. Similarly, a radio-frequency control signal (up to 100 megacycles) may be rectified by means of a germanium crystal diode such as the Type 1N34. At frequencies higher than 100 mc., a silicon crystal diode, such as Type 1N21, may be used.

A. C.-Operated Tube Relay. Figure 1 shows a low-current d. c. relay of the tube type. A 6AG7 high-transconductance tube is used in this circuit. Power can be obtained from a transformer-type a. c.-operated power supply delivering 300 volts d. c. at 30 ma., 125 volts d. c. at 10 ma., and 6.3 volts a. c. at 0.65 ampere. If there

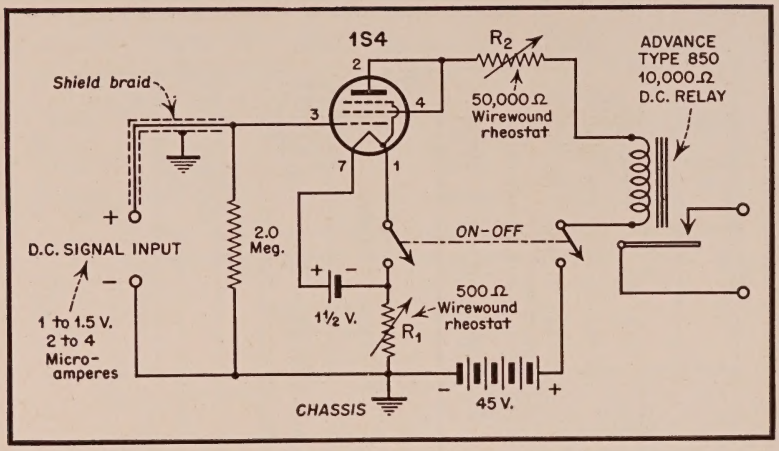

Fig. 2. Battery-operated low-signal d. c. relay.

is no objection to having the negative signal-input terminal "hot" to one side of the a. c. power line, or if an isolating transformer is employed, a transformerless voltage doubler or tripler type power supply employing selenium rectifiers may be used.

With this circuit, a d. c. control signal of 1 to 1½ volts at the INPUT terminals will close the plate-circuit relay. Approximately 4 microamperes will be drawn from the signal source. This amounts to a maximum of 6 mocrowatts of control power. The relay itself requires 1 watt for its operation, so a power amplification of more than 100,000 is obtained. The control-signal current may be made still smaller, if operating requirements necessitate, by increasing the resistance of the grid resistor from its indicated 0.47-megohm value.

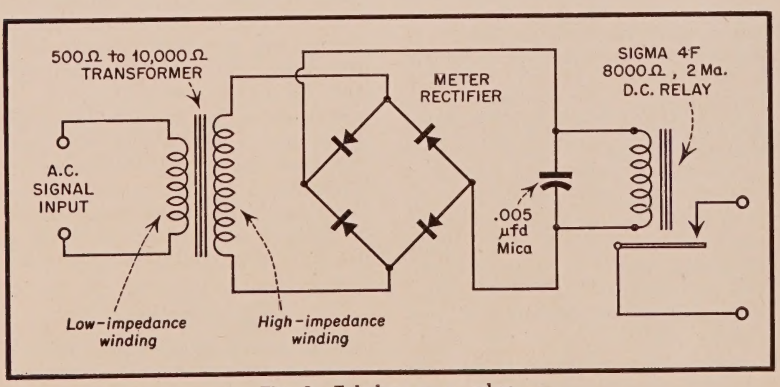

Fig. 3. Tubeless a. c. relay.

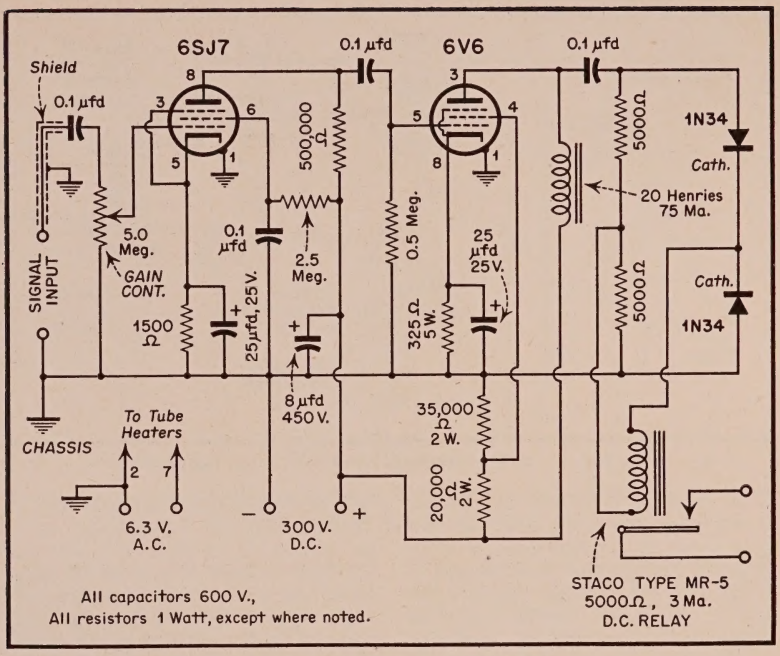

Fig. 4. Super-sensitive a. c. relay.

The following procedure must be followed when placing the circuit into operation: (1) Set the cathode rheostat at about 50 ohms. (2) Switch on the power and allow about 3 minutes for warmup time. (3) The relay will pick up as soon as the tube cathode comes up to operating temperature. With no signal applied to the INPUT terminals, adjust the cathode rheostat to a point where the relay just drops out. (4) An input signal of 1 to 1½ volts applied to the INPUT terminals now will pick up the relay. When the signal voltage is removed, the relay will drop out. Keep the input leads short and shielded to avoid a. c. pickup.

Battery-Operated Tube Relay. The circuit shown in Figure 2 achieves the same result as the one given in Figure 1 and described in the preceding section, however a battery-type power supply and low-filament-drain tube have been substituted for completion from the power line.

Rheostat R_2 is adjusted (with no signal applied to the INPUT terminals) until the relay just drops out. When the d. c. signal voltage is applied, the relay should pick up. If operation does not occur, adjust rheostat R_1 to the point where the relay does close.

A. C. Circuits

Tubeless A. C. Relay. Figure 3 shows a proven arrangement for operating a low-current d. c. relay from an a. c.

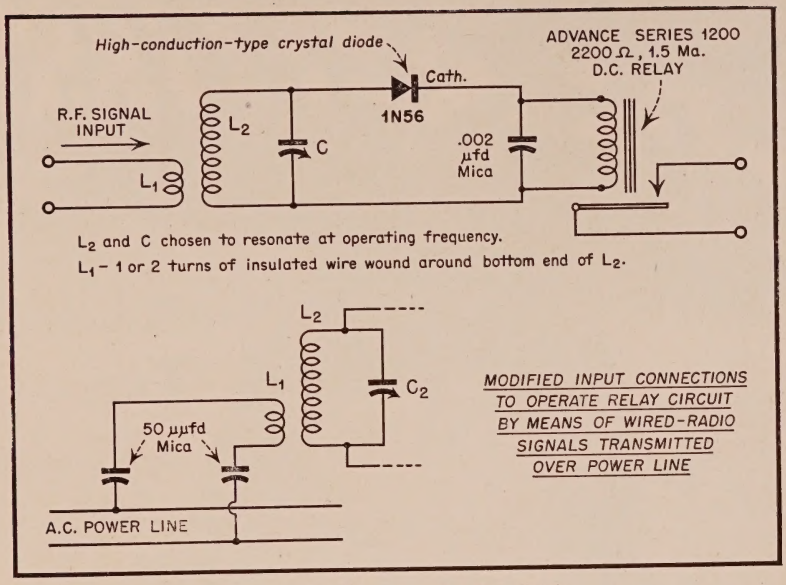

Fig. 5. Crystal-type r. f. relay circuit.

signal source. The frequency of the control signal must be confined to the audio spectrum, that is between 20 and 10,000 cycles. This signal may be transmitted over long connecting lines or may be derived from a nearby source.

A bridge-type 4-element meter rectifier is employed to convert the a. c. signal into d. c. for operation of the relay. The bypass capacitor should not be greater than 0.005 mfd., as shown, or slow drop out of the relay will result.

While a 500-ohm input transformer is shown in Figure 3, a higher or lower impedance may be employed, should 500 ohms be unsatisfactory in a particular application.

This circuit has the advantages that it is ready always for instant operation, and no power supply is required.

Supersentitive A. C. Relay. The circuit shown in Figure 4 is intended for all applications requiring relay closure on a weak audio-frequency signal (50 to 10,000 cycles) such as might be taken from long telephone lines, special wires, or the headphone output of a radio receiver. The input signal voltage must have a value of approximately 50 millivolts at 1 microwatt to pick up the relay. The high-gain 6SJ7 voltage amplifier and 6V6 power amplifier provide this sensitivity. The two 1N34 germanium diodes convert the audio output signal into d. c. for actuating the relay.

Operation of the circuit is simple. After the power has been switched on and the tubes have come up to operating temperature, apply the signal to the INPUT terminals, and advance the GAIN CONTROL setting until

(*Continued on page* 10)

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ONLY Rotator with ALL the Important Features

FEATURES	TELE-ROTOR		Rotator A	Rotator C	Rotator K	Rotator M	Rotator N	Rotator U
	TR-1	TR-2	Type 1 2					
TORQUE FT. LBS.	36	36	5½	4.5	6.75	2.25	4.5	6.00
TORQUE PER POUND OF ROTATOR	3.13	3.13	0.91	0.55	1.08	0.35	0.58	0.86
SIDE THRUST OVERLOAD (FT. LBS.) TO STOP ROTATION	525	525	94	50	83	88	110	160
WEATHER PROOFING	One piece "Water Shed" Dome Housing		Rubber Gasket	Metal Ring	Felt Washers	Rubber Gasket	Rubber Gasket	Rubber Gasket
ELECTRICAL TO MECHANICAL EFFICIENCY TORQUE PER WATTS CONSUMED	72%	58%	16.4% 16.3%	13%	11%	4%	11%	11%
TYPE OF LOAD BEARING	Two 6½ in. dia. Ball Races		Double Sleeve	Sleeve & Ball 2 in. dia. Ball Race	Sleeve	Sleeve	Double Ball Race 1 in. dia. Ball Race	Double Sleeve
MAST CAPACITY	2"	2"	1⅜"	1¾"	2"	1¾"	2"	1½"
ALIGNMENT OF ROTATOR SUPPORT MAST AND ANTENNA MAST	In Line	In Line	Off Set	Off Set	Off Set	In Line	Off Set	In Line
MOUNTING VERSATILITY	Mast or Platform		Mast Only	Mast Only	Mast Only	Mast Only	Mast Only	Mast or Side Plate
TYPE OF DIRECTIONAL INDICATION	End of Rotation Light	Dial lights 8 Positions and end	End of Rotation Meter Light	Meter	Meter	End of Rotation Light	Meter	Meter

(*Continued from page 7*)

the relay picks up. Maximum sensitivity will be obtained when the GAIN CONTROL is "wide open." It is essential that the input signal leads be well shielded and as short as possible to avoid a. c. pickup and consequent false closing of the relay.

The power supply required by this circuit must furnish 300 volts at a minimum of 55 milliamperes, and 6.3 volts at 1 ampere.

Simple R. F. Relay Circuit. A simple, effective relay circuit operated by radio-frequency control signals is shown in Figure 5. The relay requires 5 milliwatts of d. c. power for operation, and the received r. f. control signal at the INPUT terminals must have a power level somewhat higher than this figure in order to overcome losses in the tuner and crystal diode. A high-conduction diode (Type 1N56) is specified, since this type gives higher d. c. output than the better-known Type 1N34.

The control signal may be picked up by means of an antenna and ground connected to the INPUT terminals. The control signal also may be "piped" over the power line (wired radio). Shown also in Figure 5 is a capacitance coupling scheme for connecting the INPUT terminals of the relay circuit to the power line for wired radio applications.

The basic circuit, as given in Figure 5, may be used directly in the vicinity of a radio transmitter as an equipment failure alarm, actuated by loss of the radiated carrier if the relay is a normally-closed type. It may be used also in the transmitter building to operate an "on-the-air" warning lamp.

When higher sensitivity is required than can be obtained with the simple circuit, a 1- or 2-stage tuned r. f. amplifier may be connected as a booster ahead of the INPUT terminals.

Supersensitive R. F. Relay Circuit. Lower operating current may be utilized by using a Weston Model 705 microampere-type d. c. relay in the crystal circuit, as shown in Figure 6. This relay, which has been discussed already under **D. C. Circuits** earlier in this article, needs to be reset after each closure. However, in many applications this will not constitute a disadvantage.

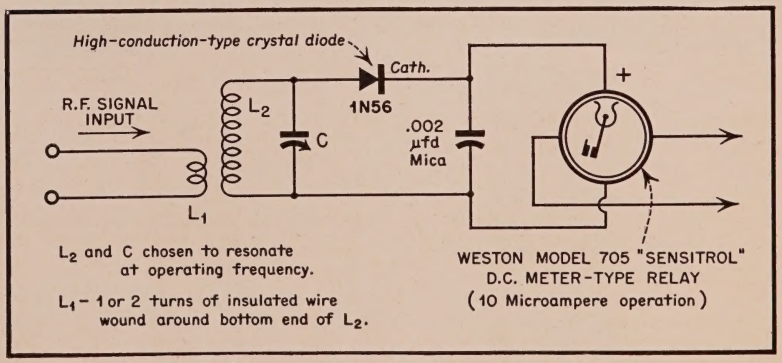
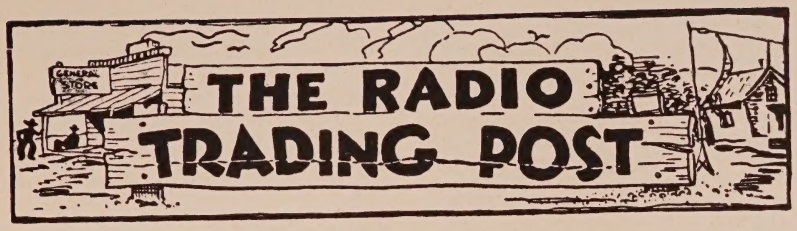

High-conduction-type crystal diode
Cath.
R.F. SIGNAL INPUT
L2
1N56
C
.002 µfd Mica
+
L1
L2 and C chosen to resonate at operating frequency.
L1 – 1 or 2 turns of insulated wire wound around bottom end of L2.
WESTON MODEL 705 "SENSITROL" D.C. METER-TYPE RELAY (10 Microampere operation)

Fig. 6. Super-sensitive crystal-type r. f. relay circuit.



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All ads are published in the order received, but those held over two issues are discarded. Every effort will be made to include your ad either in the issue being prepared or the succeeding number, but will be automatically dropped thereafter.

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SELL OR TRADE—B-45 signal generator, CA-11 signal tracer, and 431 VOM. Generator and tracer need batteries. $30 takes all three, or what have you? William Bradford, 3706 Guthrie St., East Chicago, Ind.

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SALE OR TRADE—Thordarson choke and output trans.; RCA miniature tubes; resistors; C.D. capacitors; 2-speed G. I. phono motor; Chicago output trans. J. R. Holloway, Box 133, Haddonfield, N. J.

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FOR SALE OR TRADE—2 tubes 814's GE; 3 Riders Manuals, vols. 13, 14, and 15; Gardner Code Machine with tapes, osc., and headsets. Moore Radio Shop, Allen, Oklahoma.

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FOR SALE—1250V 500ma. power supply, $35, will split; 150W speech amplifier and modulator with tubes, $25; miscellaneous parts from 300W R.F. section. Write for list. Ed Stevens, Box 277, DeRuyter, N. Y.

FOR SALE—Radio tubes and parts, no junk. Also back issues of several leading radio and TV magazines (1945 to the present). Send stamp enclosed envelope for detailed list. A. Kriegel, 701 Crotona Park North, Bronx 57, N. Y.

SELL OR TRADE—Philco AC sig. tracer; NRI multitester; BC455 with power pack; RCP 447 multitester and leads. Will sell or trade for foreign stamps or collection. Send list. Thomas R. Rohland, RD 2, Huntingdon, Pa.

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FREE—Evening Courses in Elementary and Advanced Radio Work and new courses in Elementary and Advanced Industrial Electronics are offered by the Board of Education, City of New York, Samuel Gompers Evening Trade School, 145th St., and Southern Bld., Bronx, N. Y.

FOR SALE—A 164E Dumont cathode ray oscilloscope in perfect shape, $100. Reese's Radio Service, Box 243, Franklinton, Louisiana.

SELL—Complete outfit. Hallicrafter; Skyrider Defiant high freq. rec., SX-24; speaker; telephone-telegraph transmitter HT-6, 25 watts. Also Astatic microphone D104A100658; Beede oscillator, antenna tuning, plus miscellaneous equip., $250. William Hayward, 10 Westbridge Dr., Babylon, New York.

FOR SALE—Superior Model 670 Volt-ohm-millimeter and Superior Model 247 tube tester, both only slightly used, $20 ea., or both for $35.00. Lewis E. Telford, 209 E. Hampton St., Anderson, S. C.

TRADE—Howard 7 tube FM tuner in walnut cabinet; 6-8 volt d.c. supply, tungar bulb type; tubes in cartons. Want communications receiver, good pre-war o. k. Wayne G. Taylor, 4176 West 163rd St., Lawndale, Calif.

FOR SALE—Radio parts, including testers and radio kits. Send 3 cent stamp for free list. Daniel Seidler, 4825 So. Wolcott St., Chicago 9, Ill.

FOR SALE—Single Bay DeLuxe Conical Antenna with mast. About 100' of 300 ohm lead, lightning arrestor, stand off nails, and 100 low capacity TV nails for inside wiring. All for $5. A. Gasparino, 367 West 35th St., New York 1, N. Y.

FOR SALE—Two complete sound systems, removed from sound trucks. 35 watt amplifiers, University trumpets, etc., $135 ea. Also radio shop equip., parts, write for list. Vallejo Radio Service, 58 Rodgers, Vallejo, Calif.

FOR SALE—Jensen 15" extended range co-axial speaker, in beautiful walnut Jensen cabinet, four step range control, list $120. Will deliver in N. Y. City area, $37.50. H. L. Stark, Apt. A-1, 54-72 3rd Ave., Garwood, N. J.

WANTED—Technical manuals for AN/APA-10 and ID-59/APA-11. Also manuals for other types of army scopes and indicators. Julius Wolfe, 772 Curfew St., St. Paul 4, Minn.

FOR SALE—Radio and Electrical business, well located in Rockport, Maine. Will sell parts and equip. at wholesale prices. Have franchise for well known appliances. Approximate inventory, $4,000. Write for details. Donald E. Pierce, 10 West St., Rockport, Me.

WANTED—Test, radio, or camera equip. I am an experienced draftsman and will draw any kind of plans in exchange. J. Burke, RFD 1, W. Babylon, N. Y.

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FOR SALE—7" Hallicrafter TV in good working order, with 12" magnifier included. Make offer. B. Marconi, 120 Gatling Pl., Brooklyn 9, N. Y.

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WANTED—Junior E.E. position, any location except south. B.E.E. degree, June, '50 from Pratt Institute. Former AETM 3/c with retail sales, radio wiring, shadowgraphing, and some time study experience. Resumé on request. Robert Steinman, 2046 East 36 St., Brooklyn 34, New York.

FOR SALE—Magna-Rotor antenna motor, with control box, in factory sealed carton, $16.50 fob. List price $29.50. 3 wire conductor to control motor, 3 cents a foot. Edward F. Ciuba, 409 Harvard Ave., Hillside 5, N. J.

WANTED—Used portable tape or wire recorder. Please tell price wanted, cond., give description, and method of shipment. Also number of reels of wire or tape. Donald Curtis, Box 13, Watson, La.

SWAP—Viking 65 twin cyl. engine (perfect for radio control). Want sig. gen., tracer, or make offer. T. Fujii, c/o Johnny's Cleaners, 529 So. 2nd E., Salt Lake City, Utah.

TRADE—Majestic phono-motor pickup and turntable, Chrysler model 37 auto heater, several used radios. Want used car radio, ham transmitter or receiver, home made or commercial, or what have you? Forrest E. Hancock, Laddonia, Mo.

FOR SALE—General Electric 901/910 optical unit assembly complete with deflection coil and yoke, 5TP4 projection tube, and mountings, perfect condition, slightly used. Will sell to best offer. Harold Dobb, 720 Broadway, Bayonne, New Jersey.

FOR SALE—Complete NRI Radio TV Course including experiments, good shape. Make an offer. Higgins Radio Service, Mineral, Arkansas.

WANTED—On swap basis. 40 and 80 meter command receivers, 80 meter command transmitter and modulator. Have BC654 in fair shape and working, and BC659, 10 meter mobile, with power supply, and xtals. Marc Molyneux, Jr., 53 Gulf St., Chickasaw, Alabama.

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FOR SALE OR TRADE—SCR 284 complete with P.E.103 dynamotor, P.E.104 vibrator, C.D. 501 power cord, excellent cond.; SCR 610 transmitter receiver; Meissner signal shifter with 10 sets of coils. Prefer 10 and 20 meter transmitter. Make an offer. W. L. Campbell, Jr., 2450 Taylor St., Mobile, Ala.

WANTED—RCA wire recorder cartridges, wire broken or unbroken. Have 7DP4, deflection yoke, output and HV transformer for same. Will take cash for television parts. Robert Flory, 29 Harold Ave., Princeton, New Jersey.

FOR SALE—Howard 7 tube "Driftless Tuning 482" FM converter, like new, used little, $19.50. John Compel, Jr., 1165 Oak St. S. W., Warren, Ohio.

SELL OR SWAP—Triumph Model 500 C-R-L bridge. .005-20 mfd, 5 ohms - 2 megs, .05-20 mh. Provisions for any ext. std. Leakage test for C. Sell for $15 or swap for freq. meter, or what have you? Donald Dee Waltner, RFD 2, McPherson, Kansas.

FOR SALE OR TRADE—Have three 307A (RK-75) tubes. Will sell or trade for 807's, 6L6's or what have you. G. Sabin, 3507 - 15th St., Tampa 5, Fla.

SELL OR TRADE—Radio City Products Co. sig. gen., model 701; Mark II transmitter-receiver; NRI Radio-TV Course and tester; radio diagrams and servicing information on most popular radios from 1928-1946. Meredith E. Atkins, 110 North Ave., Sumner, Illinois.

SWAP—One pair National Union 813's for command set, BC946 or ARC5 R-24 500 to 1500 kc. receiver. Must be unconverted. What do you want? Have 810's, 8005's, 872A's 866A's, etc. James E. Higgins, 307 Wayne St., Highland Park, N. J.

WANTED—A going small radio repair business anywhere in Florida. Have all test equipment for FM and TV. Give full details in first letter. Ben Roller, 8743 Hosmer Ave., Detroit 14, Mich.

FOR SALE—RCP Multitester, model 447A; General Electric Luminaire control (photo electric type), 900 watt; Allis-Chalmers 5½" ammeter, a.c. 5 amp. coil calibrated 0-600 amps. Want surplus radio equipment. Emil Kalar, South International Falls, Minnesota.

FOR SALE OR TRADE—G.E. 12" PM spkr.; 78 rpm. record changers (2); sig. gen.; tube checker; tubes; meters; radio books; fluorescent lamps; chokes; transformers; condensers. Need Sam's Photo Facts and Rider's TV Manuals. Val Sanford, 71 West 104 St., New York 25, N. Y.

SELL OR TRADE—F-3 Wilcox receiver (same as CW-3) with conversion instructions, $50; almost new 375-E transmitter with manual, $50; 274N set, $45; 28V x 200A aeroplane type generator, $22; BC1073 wave meter with case, $22.50.. Interested in TV set, wire recorder. James Z. Cole, 634 Elmwood Ave., Niagara Falls, N. Y.

SALE OR TRADE—Have 25B8, 25A7, 25AC5, 25A6 tubes. Want Rider's vols. 10 to 14 Manuals, or other manuals between 1939 and 1942. Kramer's Radio Service, 36 Columbus Ave., New York 23, N. Y.

FOR SALE—RCA Rider Chanalyst, excellent condition, $110; Supreme tube tester, Model 599A, $40; Astatic TV booster, $35. Also other parts, write for list. F. C. Yaunk, 3108 Ave. H, Fort Madison, Ia.

TRADE—NRI tester, VTVM battery type, less batteries, with instructions. Want portable battery radio. Frank Wurst, 242 Dayton Ave., Clifton, N. J.

WANTED—Hickok Model 209 volt ohm capacity meter. Have 7" and 10" TV sets to trade for same. Troch's, 290 Main St., Spotswood, New Jersey.

WANTED—Good 7 x 50 to 9 power binoculars, target pistol, 38 special, deer rifle, 12" to 16" TV set. I have $1,500 worth of radio shop equip. and ham gear. Earl E. King, 614 N. Clark Ave., Elmonte, Calif.

FOR SALE OR TRADE—BC348-0, new condition, 110V a.c., complete with speaker, manual; SCR 610 complete, fair cond. Want small TV, test equipment, or cash. Robert R. Jessup, New Baden, Ill.

FOR SALE—Assortment of radio-electrical books and radio courses. Clearance prices. Write for list. A. J. Wrobel, 207 Wyandotte St., Lester, Pa.

SWAP—Electric motors, fans, machinery, drills, saws, etc., all sizes and types, big variety. Want good communications ham receiver, new or in good cond., as complete unit. W. B. Soble, 6048 Alma St., Philadelphia 24, Pa.

FOR SALE—10" television set with all tubes, less cabinet, in good working condition. Oil-filled magnifier for above set, telekit booster, all in good cond., $100 fob. P. A. Uricchio, 116 Franklin Ave., Hartford 6, Conn.

FOR SALE—Plate transformers, two section secondary 1500V each sec., 1 amp; chokes, 15 henry, one half amp., German make. Simplex Radio Service, 1511 Alton, Denver 8, Colo.

FOR SALE—11-10-6 meter converter DM-36, $35; 803 pentode transmitting tubes, 320 watts input with 2 watts grid drive, $3.50. J. D. Duffin, 406 First Ave., Haddon Heights, New Jersey.

FOR SALE—Rear seat auto radio speakers. Complete kit including 3-way switch, wire, etc., $3.50 postpaid. Simon L. Cherry, 1438 Belfield Ave., Philadelphia 40, Pa.

FOR SALE OR SWAP—5" Heath Kit scope (assembled); Instructograph code machine w/tape; Underwood typewriter; Philco 7051 tube tester. Want Geiger counter, movie projector, or what have you? Howard Hampton, City Radio Service, Norton, Va.

FOR SALE—Precision 912 tube tester; Weston 772 multitester; Hickok 227X sig. gen.; nearly 400 tubes; Sam's Photofacts 1 to 94 in books; Riders 1-8; cost $1,300. If interested write. Everything must be sold together. H. P. Towner, Sr., Box 226, Dalton, New York.

FOR SALE—Federal 269 enlarger, $28; FM Pilotuner, $18; Webster 156 converted for standard and LP records with 3 GE cartridges, GE pre-amp, crystal cartridge with nylon needle, $24. Norman W. Tetenman, 225 Roebling St., Brooklyn 11, New York.

FOR SALE— Model 162 RCA Chanalyst, with steel mounting rack and instruction book, complete, $75. J. J. Papovich, 216 Broadway, Westville, N. J.

FOR SALE—Kelsey 3 x 5 printing press, complete with type, inks, extra chases, in brand new condition, $75; 2 tube short wave battery set, complete with batteries, coils, phones, $25. John Handzo, Jr., 748 Drake Ave., Roselle, N. J.

WANTED—New or used RA-20 power pack. Have practically new BC348Q, used about 20 hours, with manual, shock mount, and in original wooden packing box, $85 cash or trade for New BC344D or BC342N. Joe Darnell, Rt. 5, Box 341, Bristow, Okla.

FOR SALE—Howard FM tuner, 7 tube, 4 months old; Jerrold FM-TV sig. booster, 4 months old; Meissner wave trap. Total new price nearly $60. Sell as unit for $45, or singly. James H. Littig, Kasota, Mich.

FOR SALE—Complete files "Service." Bound vols. 1932 to 1941 inclusive; not bound 1942 up to 1950, condition good to excellent. Any reasonable offer considered. George Harold, 107 Kennison Dr., Orlando, Florida.

WANTED—Rider's Manuals, need nearly all volumes. Will pay cash or also have large stock of tubes (60% off list) and Webster-Chicago Record players to trade for manuals. Lewis J. Hagenbrock, 701 Minneapolis Ave., Duluth 3, Minn.

FOR SALE—Bogen E-10 amplifier, $35; Webster-Chicago 256-1 changer, $25; 12" coaxial speaker, $15; or all for $65. Has been used in home less than 3 months. William A. Moose, 3725 Baldwin, Detroit 14, Mich.

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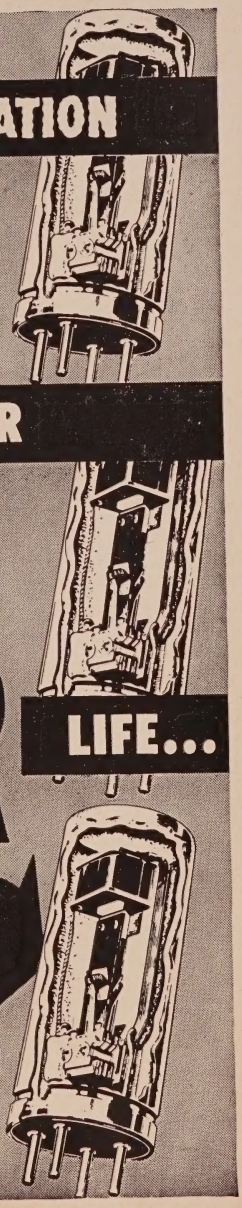

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